

Potential Infectious Disease Threats for Southern Resident Killer Whales



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Bacteria?

Viruses?

Fungi?





Southern Resident Population

Are infectious diseases involved in the decline?

What risk do they pose to recovery?



Necropsy Reports



- Carcasses recovered from only 8 known southern resident animals
- Postmortem examinations only completed on several individuals
- Unable to get much information on infectious diseases from reports



Goals

- Review known infectious diseases (bacteria, viruses, and fungi) of killer whales
- Evaluate if any of these diseases could be playing a role in the decline of the southern resident population
- Determine if there are diseases that could threaten the long-term viability of this small population



Diseases reported in free-ranging killer whales

3

- Antibodies to *Brucella* spp.
 - *Edwardsiella tarda*
- Cetacean pox virus (Orthopoxvirus)



Reported Bacteria (captive and free-ranging killer whales)

- *Brucella* spp.
- *Burkholderia pseudomallei*
- *Clostridium perfringens*
- *Erysipelothrix rhusiopathiae*
 - *Nocardia asteroides*
 - *Nocardia otitidiscaviarum*
 - *Salmonella* sp.
- *Streptococcus* sp., beta-hemolytic



Reported Viruses

(captive and free-ranging
killer whales)

- Cetacean Poxvirus
- Cutaneous papilloma virus
- Hepatitis-B like virus (hepadenovirus)
- Influenza (suspected; no virus isolated)



Reported Fungi (captive and free-ranging killer whales)

- *Aspergillus fumigatus*
 - *Candida alibicans*
- *Saksenaea vasiformis*

Sympatric Odontocetes

- Bottlenose dolphins (*Tursiops truncatus*)
 - Dall's porpoises (*Phocoenoides dalli*)
- False killer whales (*Pseudorca crassidens*)
 - Harbor porpoises (*Phocoena phocoena*)
- Northern right whale dolphins (*Lissodelphis borealis*)
 - Pacific white-sided dolphins (*Lagenorhynchus obliquidens*)
 - Risso's dolphins (*Grampus griseus*)
- Short-beaked common dolphins (*Delphinus delphis*)
- Short-finned pilot whales (*Globicephala macrorhynchus*)
 - Striped dolphins (*Stenella coeruleoalba*)



Reported Bacteria (sympatric odontocetes)

Free-ranging

- *Actinomyces bovis*
- *Helicobacter* sp.
- *Vibrio alginolyticus*
 - *Vibrio damsela*
- *Vibrio parahaemolyticus*

Captive

- *Nocardia braziliensis*
 - *Nocardia caviae*
- *Nocardia paraguayensis*
- *Pasteurella hemolyticum*
 - *Pasteurella multocida*
- *Pseudomonas pseudomallei*
 - *Staphylococcus aureus*



Reported Viruses

(sympatric odontocetes)

Free-ranging

- Herpesviruses
- Morbillivirus, Dolphin
- Morbillivirus, Porpoise

Captive

- Caliciviruses



Reported Fungi (sympatric odontocetes)

Free-ranging

- *Coccidioides immitis*
- *Cryptococcus neoformans*
 - *Loboa lobo*
 - *Rhizopus* sp.

Captive

- *Apophysomyces elegans*
- *Aspergillus flavus*
- *Blastomyces dermatitidis*
- *Cladophialophora bantiana*
- *Histoplasma capsulatum*
- *Mucor* sp.
- *Sporothrix schenckii*
- *Trichophyton* sp.

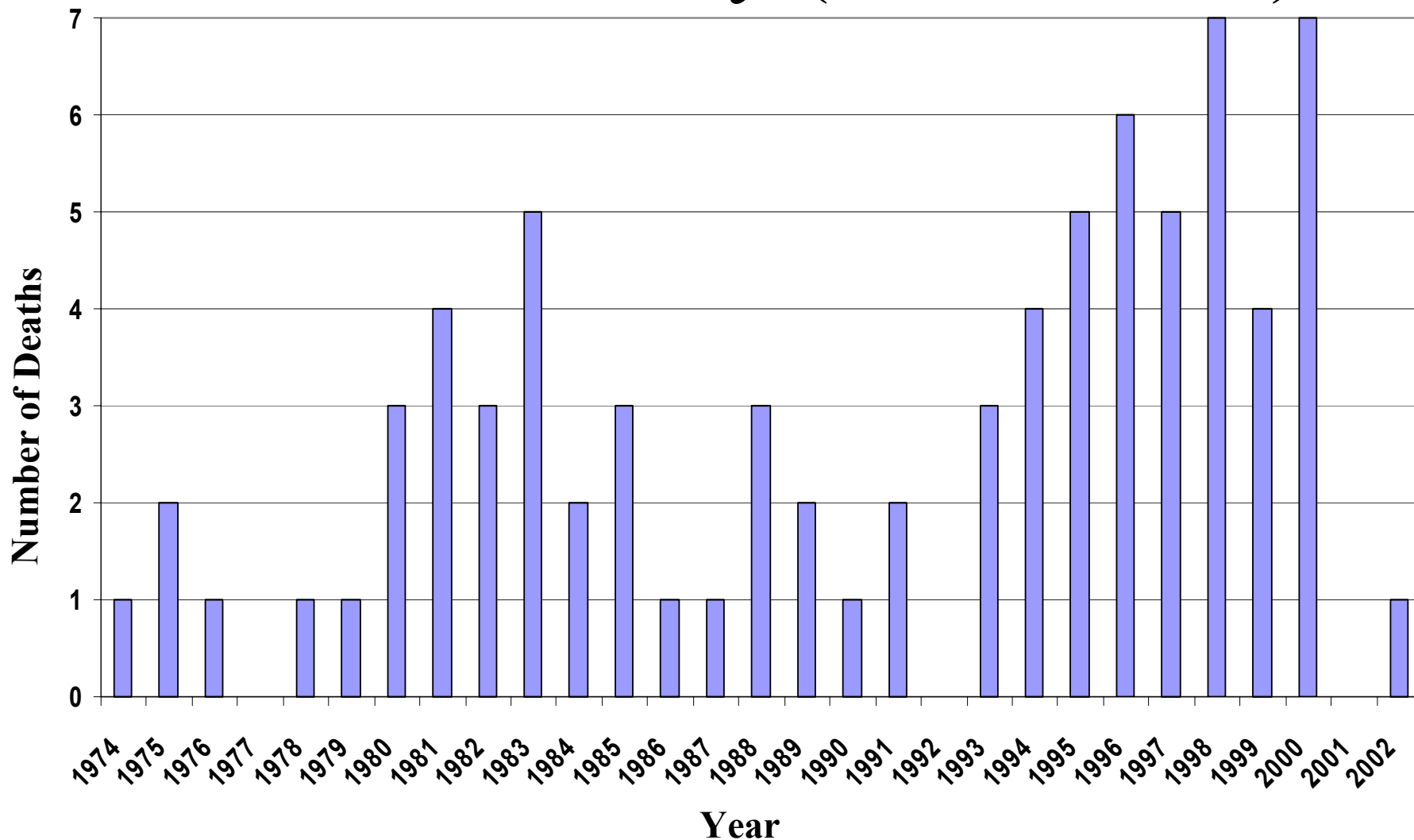


Results

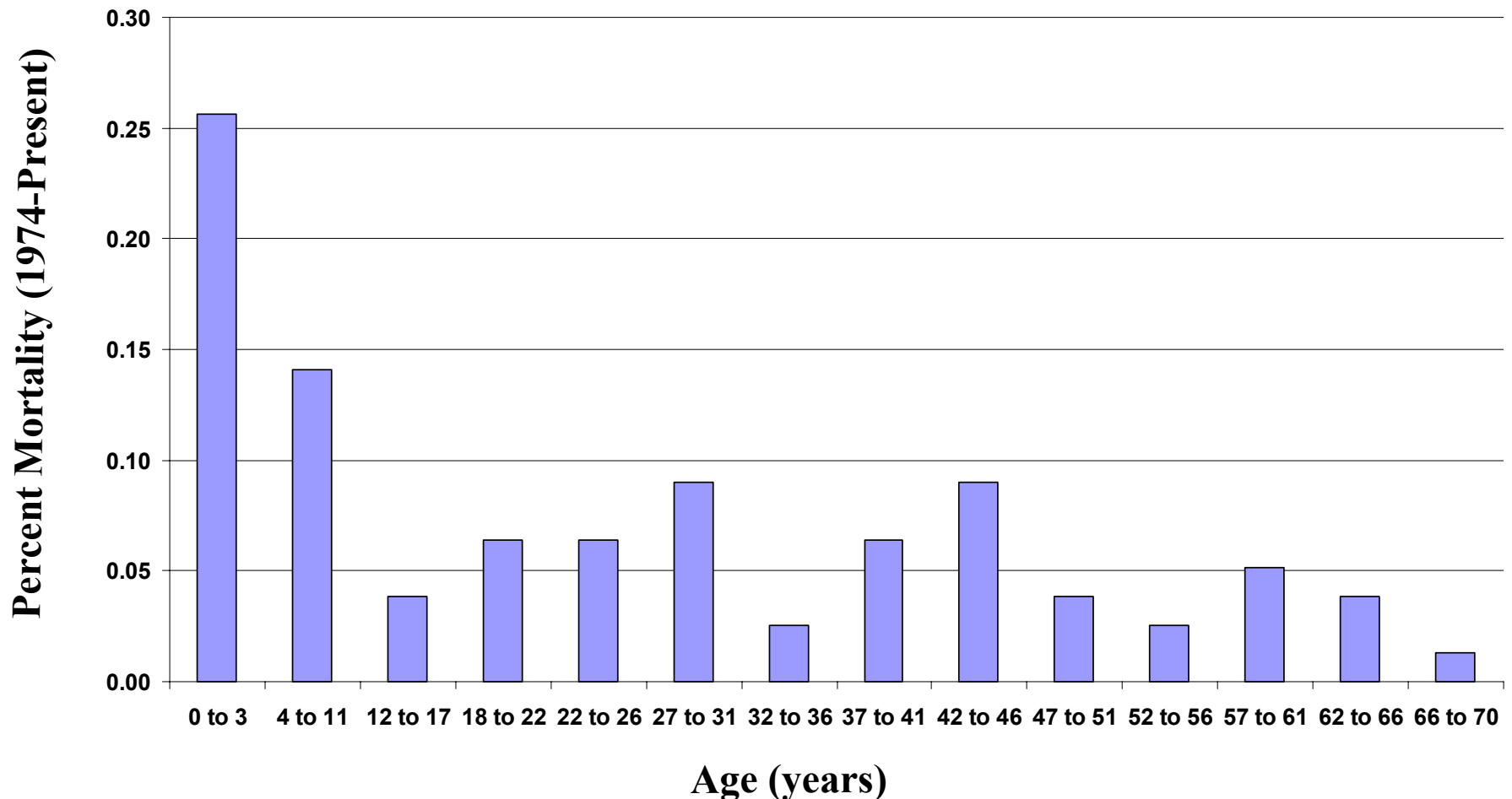
- Identified 16 infectious agents previously reported in free-ranging or captive killer whales
 - 190 identified in a recent elk translocation disease risk assessment
- Identified 28 infectious agents previously reported in free-ranging or captive sympatric odontocetes, but not in killer whales



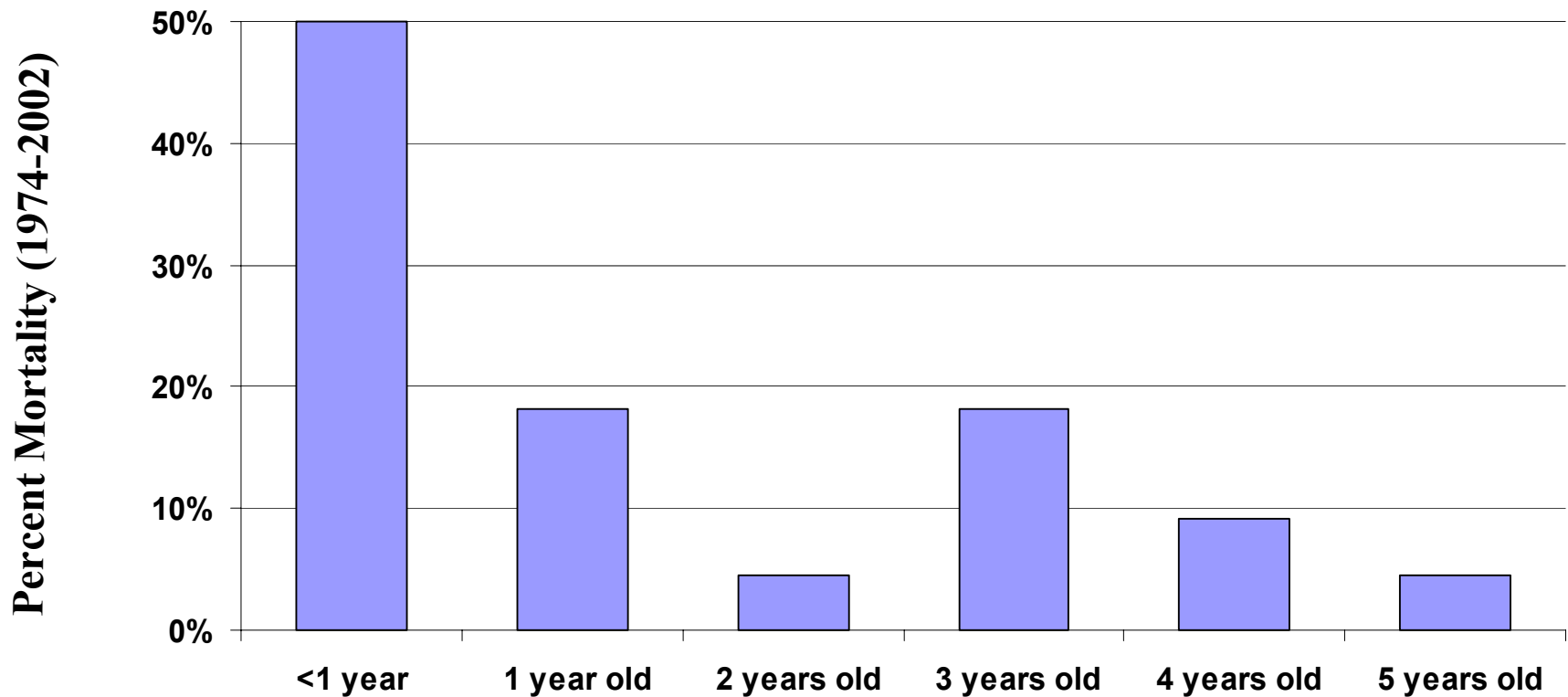
Annual Southern Resident Killer Whale Mortality (1974 – 2002)



Southern Resident Killer Whale Mortality (1974-2002; n=78)



Southern Resident Killer Whale Mortality (0-5 year olds, n=22)



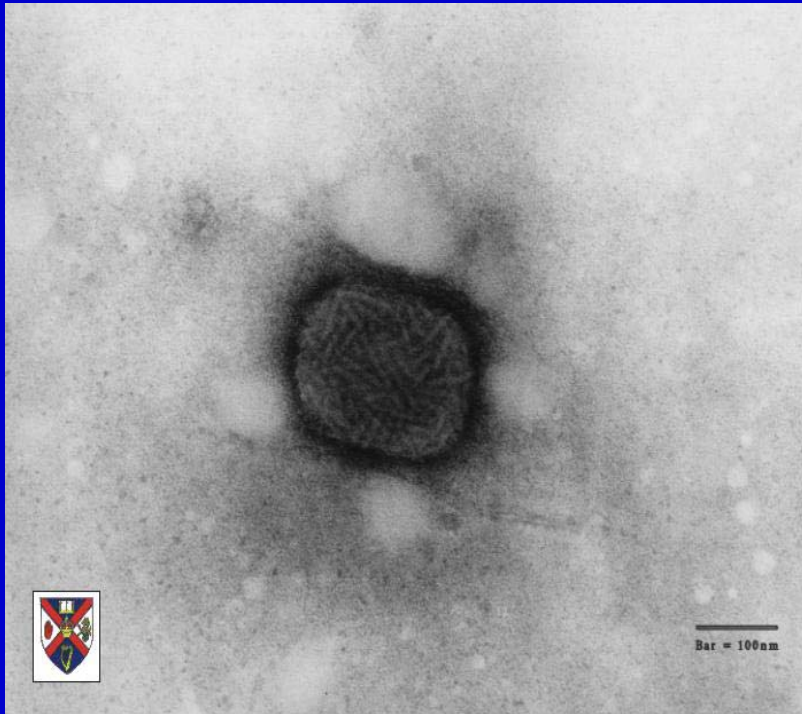


Infectious Diseases that could be important regarding neonatal mortality

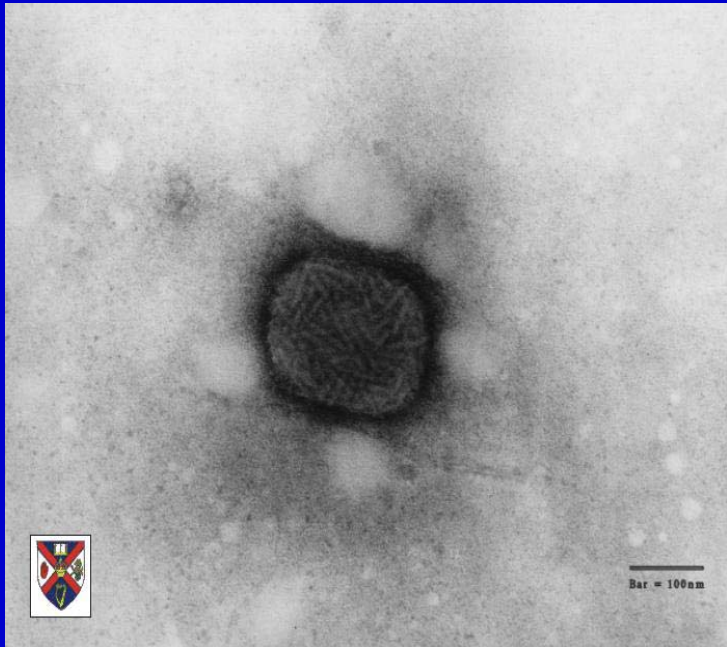
Cetacean Poxvirus

Cetacean Poxviruses

- Probable Orthopoxvirus etiology
- Infections manifest as skin lesions and do not usually affect general health
- Often called tattoo lesions
- Stress and environmental conditions may play a role in the clinical manifestation of infection



Cetacean Poxviruses



- It has been hypothesized that infection may kill cetacean neonates and calves without protective immunity
- Infection can cause cutaneous lesions in killer whales
- Do have in odontocetes in the eastern Pacific
- More research is needed before impact on southern resident population can be assessed



**Infectious Diseases that
could be important
reducing fecundity or
reproductive success**

Brucella spp.

Marine *Brucella* spp.



- Gram negative bacteria
- An emerging marine mammal disease
- Isolated from numerous marine mammals; many others have antibodies
- Pathogenesis and significance in odontocetes are not well understood

Marine *Brucella* spp.



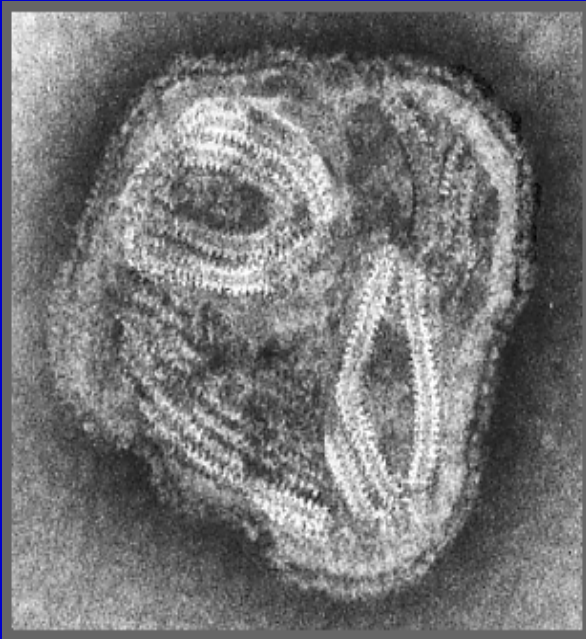
- Reported to cause abortion in bottlenose dolphins
- Antibodies found in killer whales
- Could play a role in reduced recruitment within the southern resident population



Infectious Diseases that could threaten the long- term viability of the southern resident population

- **Morbilliviruses**
- **Herpesviruses**

Morbilliviruses



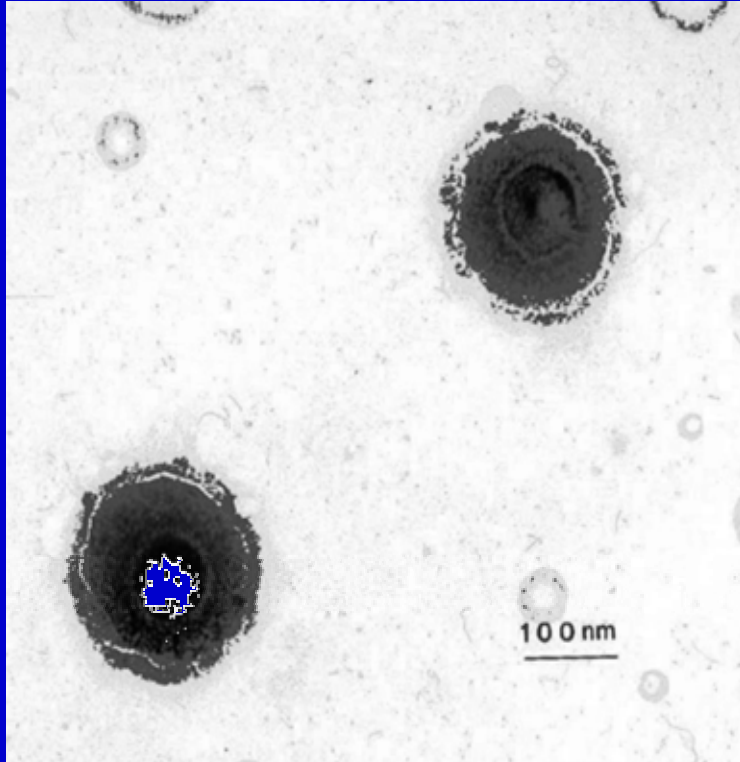
- Dolphin and Porpoise morbilliviruses may be strains of the same virus (cetacean morbillivirus)
- Have caused epizootics in bottlenose dolphins (Atlantic), striped dolphins (Mediterranean), and possibly short-beaked common dolphins (Black Sea), and mortality in other species
- Morbilliviruses are considered highly virulent for some species



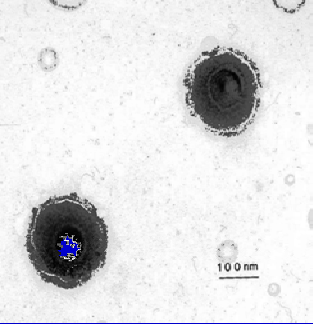
Morbilliviruses

- Cetacean morbilliviruses may have long-term effects on the dynamics of cetacean populations either as enzootic infections or recurrent epizootics
- Antibodies to cetacean morbilliviruses have been found in stranded common dolphins from the eastern Pacific
- If cetacean morbilliviruses are virulent in killer whales, an epizootic in southern resident population could be catastrophic

Herpesviruses



- Historically thought to just cause skin and mucosal lesions in cetaceans
- Have caused encephalitis in harbor porpoises
- Recently disseminated herpesviral infection was reported in two bottlenose dolphins (alphaherpesvirus)



Herpesviruses

- Disseminated infections in bottlenose dolphins and encephalitic infections in harbor porpoise could represent:
 - recrudescence of a latent infection
 - infection in immunologically naïve animals
 - atypical infection in aberrant host
- Herpesviruses should be investigated as a potential threat to the long-term viability of the southern resident killer whale population



Discussion

- Information on infectious diseases in killer whales is sparse
- Making assumptions based on limited knowledge of infectious diseases in sympatric odontocetes can be flawed



Confounding Factors

- Pathogen virulence may not be the same in killer whales when compared to sympatric odontocetes
- High PCB levels in southern resident killer whales may increase their susceptibility to infectious agents, making “low” virulence pathogens more virulent in this population



Recommendations

- Complete postmortem examinations should be performed on all stranded killer whales
- A standardized necropsy and disease testing protocol for killer whales should be developed
 - Importance of other pathogens, including protozoal pathogens like as *Toxoplasma gondii*, need to be evaluated



Toxoplasma gondii

- Major mortality factor in Southern Sea otters
- Origin is domestic and wild felids
- Close association with freshwater run-off

Work that is underway...

- Preliminary data on killer whale strandings and necropsies world-wide
 - 73 strandings /deaths
 - 11 necropsies (8 captive)
- Preparing a standardized necropsy protocol for captive and wild killer whales